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ABSTRACT

One of twelve water treatment technology units, this student manual on springs provides instructional materials for two competencies. (The twelve units are designed for a continuing education training course for public water supply operators.) The competencies focus on spring basin construction and spring protection. For each competency, student objectives, information sheets, learning activities, and evaluation activities are provided. An evaluation form with answer key is provided for one of the competencies. (JH)

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Water Treatment Technology

SPRINGS

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SPRINGS
EVALUATOR'S COPY
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EVALUATOR'S INSTRUCTIONS

Name _____

Address _____

Phone _____

This is your EVALUATOR'S COPY of the SPRINGS unit. It contains all of the materials received by the operators who will be working on the unit. It also contains *answer keys* and *directions* for the evaluation of each competency. For each Competency Sheet, there is a COMPETENCY, a list of RESOURCES, LEARNING ACTIVITIES, and EVALUATION ACTIVITIES.

Your student operators will call you when they are ready to be evaluated. An operator may complete the evaluations in *any* order. S/he may choose to complete one at a time, or several at one time. *It is up to you and each operator to set convenient schedules for the evaluations.* It is important that the operators learn the skills listed in each competency. It is your job to be sure the operators can perform the competencies.

If an operator does not complete an evaluation correctly, s/he may try again later after practicing the skills. It would be helpful for you to tell the operators just how they should improve their knowledge and skills in order to complete the evaluation successfully. Be sure to call if you have any questions.

This package contains:

- - - - - SPRINGS unit

- - - - - Evaluation Forms for each competency

. You will receive instructions as to where to send the completed evaluation forms. Please be sure that the operator's name and your name are on the forms, as well as the date on which the evaluation was performed.

INSTRUCTIONS FOR THE STUDENT OPERATOR

The SPRINGS unit contains two competencies. A "competency" is a skill that is necessary for good on-the-job performance. Each competency in this unit is necessary for you to perform on the job according to the West Virginia Department of Health. There is a Competency Sheet to help you understand each competency.

DIRECTIONS FOR COMPLETING THE UNIT:

1. Read each Competency Sheet carefully. Every Competency Sheet contains:

COMPETENCY

Objectives

RESOURCES

LEARNING ACTIVITIES

EVALUATION ACTIVITY(IES)

2. After reading the whole Competency Sheet, you should understand what will be expected of you.
3. Do the LEARNING ACTIVITIES that you think will help you the most. This may include reading some of the RESOURCES which have been included with the unit.
4. If you need additional help, ask an operator in your plant for assistance, or call your evaluator; he's there to help you.
5. When you are ready to complete the EVALUATION ACTIVITY for one or more competencies--call your evaluator. The two of you will schedule the best time for your evaluation.
 - a. If you complete the evaluation correctly, go on to the next competency.
 - b. If you do not complete the evaluation correctly, your evaluator will tell you what your mistakes were. You must go back and practice your skills and read the RESOURCES again. Call your evaluator when you are ready to try again. *You must wait at least one week before being re-evaluated on a competency.*

SEE NEXT PAGE

6. When you complete all your evaluations correctly you will receive a Certificate of Accomplishment and 0.4 Continuing Education Units of Credit.
7. If you want to go on to another unit, contact your evaluator for the materials. The procedure will be similar for all units.

AN EXPLANATION OF CONTINUING EDUCATION UNITS

For student operators in the OPERATOR-IN-TRAINING category who will be taking the certification examination for Class I, this course is an opportunity to increase your knowledge and competence in the treatment of water for human consumption. Successful completion of the manuals will also, it is hoped, make passing the certification exam much easier. The Continuing Education Units which you will get by taking this course will not decrease the minimum one year operating experience requirement for a Class I certificate.

For student operators who now hold a Class I certificate, the completion of all twelve manuals in the course will reduce the currently required three years of total operating experience for Class II certification by approximately four months. Thus, if you complete the course, you will need only two years and eight months of total operating experience before you take the Class II exam.

Here is a listing of the Continuing Education Unit (CEU) value of each of the manuals.

<u>Manual</u>	<u>CEU Value</u>
General Plant Operation	1.4
Taste, Odor, and Color	0.6
Chemistry/Bacteriology	2.5
Chlorination	2.5
Fluoridation	0.6
Filtration	1.2
Hydraulics	0.6
Distribution Systems	1.2
Pumps	0.6
Wells	1.0
Cross Connections	0.4
Springs	0.4
Total	13.0

For comparison with other types of training previously available, the CEU conversions below are given.

Public Water Supply Operator's Short Course (given by State Department of Health Personnel)	4 CEUs
One Semester Hour of College Credit	1.5 CEUs
One Year of College Credits (30 semester hours)	45 CEUs

- COMPETENCY: Sketch, label, and describe the construction of a spring basin.
- Objective: Identify and describe the purpose of the basic parts of a spring basin.
- Objective: Sketch a spring basin showing and labeling all basic parts.

- RESOURCES:
- (a) "Spring Construction" Resource Sheet.
 - (b) "Springs" Resource Sheet from Springs #61.

- LEARNING
ACTIVITIES:
- (a) Read the Resources listed above to find information about the construction of spring basins.
 - (b) Visit the site of a spring basin and examine the construction. Use the Resources as a reference to locate the various parts of the basin.
 - (c) Practice sketching a spring basin. Your artistic ability is not important. Be sure to include all important parts of the basin and surrounding area. Label each part.

EVALUATION
ACTIVITY:

You will be expected to sketch, label, and describe a properly constructed spring basin. The following parts should be labeled on your sketch:

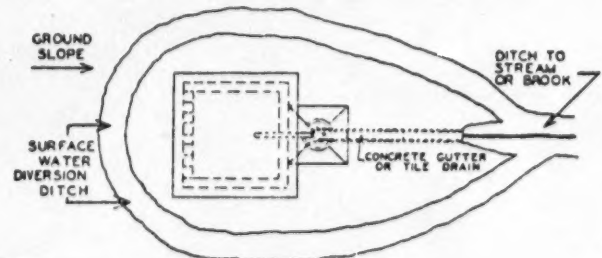
spring flow	overflow gutter
walls; cover	water diversion ditch
supply line	
screen & flap valve on overflow pipe	

"SPRING CONSTRUCTION"*

Springs occur where a water-bearing stratum reaches the surface of the ground or where fissures in rock "outcrop" at the surface under conditions so that ground water is forced through the fissures. The first type of spring is usually of local origin and great care must be taken to eliminate nearby sources of pollution. The origin of the water flowing from a rock spring is difficult to ascertain without detailed knowledge of the geological formations in the area.

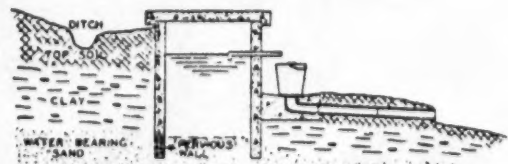
Regardless of the type of construction, all spring basins should be covered, and the water source should be permanently protected by a structure of concrete or other impervious material so all water except that issuing from the spring will be excluded.

Surplus water should be piped from the covering structure in such a manner that surface water cannot enter the spring even during floods. It is not necessary to ventilate spring structures; all openings should be covered. Inspection manholes should be fitted with tight locked covers.

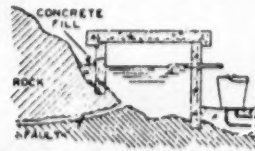


TYPICAL SPRING BASIN CONSTRUCTION

PLAN



SECTIONAL ELEVATION - SPRING IN SAND



SECTIONAL ELEVATION - SPRING IN ROCK

*Source: Manual of Instruction for Water Treatment Plant Operators, New York State Department of Health, Health Education Service, P.O. Box 7283, Albany, N. Y. 12224, pp. 13-15.

COMPETENCY: Describe how to properly protect a spring to be used for potable water.

Objective: Describe potential problems which may result from a spring which is not properly protected.

Objective: Describe all procedures necessary for the proper protection of a spring.

RESOURCES: (a) "Springs" Resource Sheet.
(b) "Spring Construction" Resource Sheet from Springs #60.

LEARNING
ACTIVITIES: (a) Read the Resources listed above to find information about proper spring protection.
(b) Visit the site of a spring used as a source for potable water. Note the construction of the spring basin. There should be a ditch above the basin to divert surface water from entering the basin. The overflow pipe should be above flood elevation with a concrete or tile overflow gutter leading away from the basin. The walls and top of the spring basin should be concrete 5 to 6 inches thick.

EVALUATION
ACTIVITY:

Complete Evaluation Form #61. It contains questions about how to protect a spring to be used for potable water and indications of improper protection. You may not use references.

"SPRINGS"*

Springs are notorious for failure, flooding, and yielding less than that reported. *No spring should be developed until its capacity has been measured several years.* Preferably, the spring flows should have been measured and observed during a historical drought of record. No spring should be developed to pump more than the lowest recorded flow. This is all that it will yield when water is needed most. The dependable yield may be even less than the recorded low flow. One cannot depend upon the word of early settlers or long-time residents when they state, "The flow never diminishes in dry weather, it never gets muddy, it never floods, etc., etc."

In all cases where a spring is used as a source of potable water it should be observed for turbidity after rainfall. This should be done even when rains occur in a radius of several miles from the spring. Turbidity would be one indication as to whether or not surface water contributes to the spring flow as well as the dependability of the spring.

Spring flows should be measured after rainfall during wet seasons as well as during dry seasons. In making these measurements, an entrapment should be provided so that all flow will pass through one area. A weir or other suitable device can then be installed to measure the flow. When the use of a spring is considered, the minimum information necessary would be that as outlined above. Proper spring protection measures must be incorporated in construction after the following factors are determined: 1) yield is satisfactory, 2) water clear at all times, 3) water bacteriologically safe, 4) water chemically satisfactory, 5) location satisfactory.

In flood zones, the construction and necessary safeguards are usually very expensive. In many cases the cost may exceed that for constructing a well. *If any other satisfactory source is available, a spring subject to flooding is not acceptable.*

The basic principles for protecting a spring are shown in the simplified drawing in Figure 1. The geology of the area around a spring, the population concentration, and type of facilities in the area are most important. Basically, protection of a spring consists of construction to *exclude flood water, surface contamination, entrance of insects, animals, and unauthorized persons.* A substantial fence should be constructed around the area. Many springs are located so that they are subject to flooding by water backing into them from nearby streams. Flood waters are subject to all types of contamination and are very dangerous. During floods in Alabama in 1961, one spring which was the source of a public water supply became flooded and over 600 people had dysentery.

*Source: Water Works Operators Manual, Alabama Department of Public Health, Bureau of Environmental Health, Third Edition, 1972, Chapter IX, pp. 12-13.

Drawing showing basic principles
used in protecting a spring.

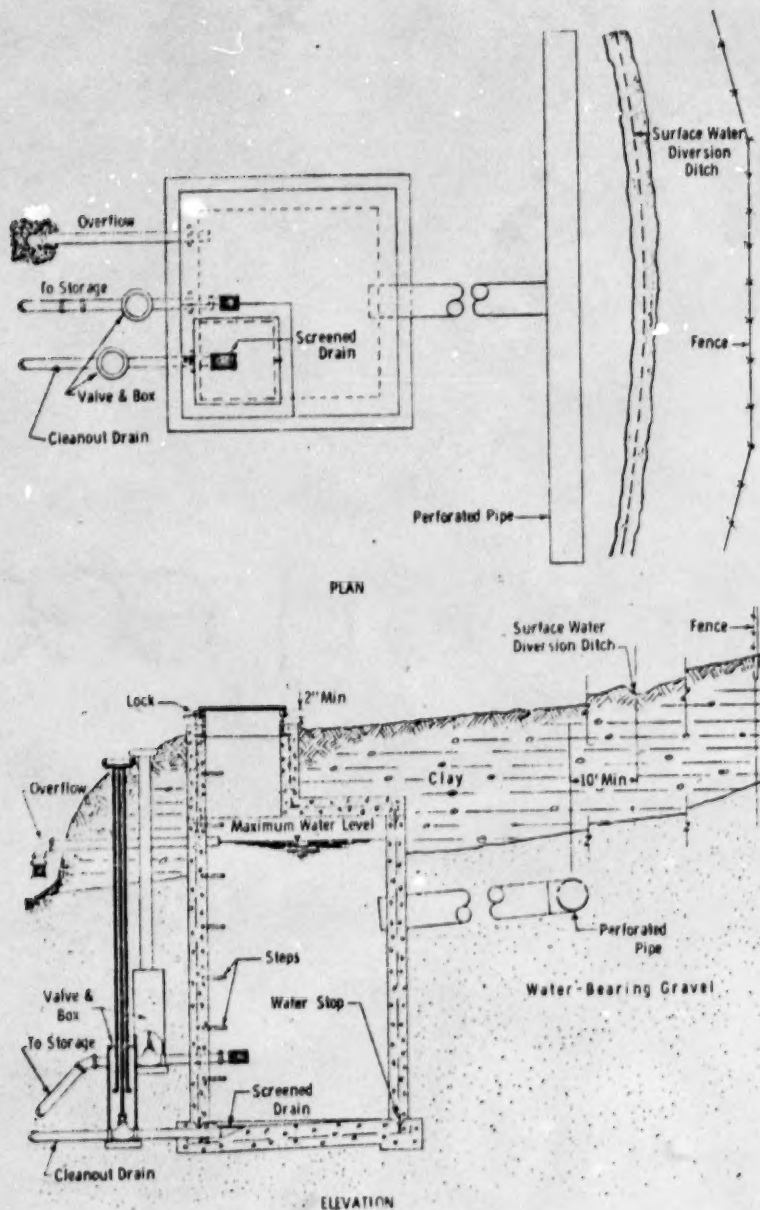


FIGURE 1 Spring protection.

A word of caution - - - the level of a spring can be raised only a little or it will be subject to emerging elsewhere and the development will be lost.

Operator _____

Evaluator _____

Date _____

Directions: Write the word "True" or "False" in the space provided next to each item. If you answer "False" write the correct answer on the lines under the item.

1. True Rain several miles away from an unprotected spring may cause the spring water to be turbid.

2. False The rate of flow of a spring usually stays the same regardless of rainfall.
Spring flows fluctuate greatly.

3. True A ditch should be dug above the spring to divert water which may wash down into the spring.

4. True If flooding would occur regularly near a spring, the spring should not be used as a source of potable water.

5. False Concrete spring basin walls should be about 1-3 inches thick.

Concrete sides and top of spring basin should be at least 5-6 inches thick.

6. False It is not necessary to install overflow pipes on spring basins.

Overflow pipe should be installed above flood elevation with a concrete or tile overflow gutter leading away from the basin.
